Operating Instructions Rittal SK Microcontroller (+PLC +BUS)

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1 General

The present operating instructions are provided for a Rittal enclosure cooling unit with microcontroller.
They describe the operation and programming of the microcontroller and the fault messages issued. In addition, they contain notes on the elimination of malfunctions.

The technical data and further information (diagrams, etc.) can be found on the name plate of the cooling unit or in the Rittal assembly instructions (see the system documentation).

To avoid too high a level of condensation, a door limit switch must be connected to terminals 1 and 2. This causes the cooling unit to be switched off ca. 10 sec. after the door has been opened.

Further options connectable to the cooling unit:
(see also the assembly instructions)
PLC interface
Transfers system information to a programmable controller (PLC).

BUS system
(Model No. SK 3124.000)
Interconnects several cooling units.

Collective fault message
A potential-free contact is available for issuing fault signals; this contact can be used to integrate signal transmitters.

Rittal diagnostic software (RiDiag)
(Model No. SK 3159.000)
Allows diagnostic operations and programming to be carried out using a PC or a laptop.
The pertaining operating instructions are included with the program disks.

The present operating instructions must always be kept with the unit.

2 Notes Regarding Safety

- The cooling unit must only be used for cooling enclosures. Any other application is not permitted.
- Observe the operating instructions.
- Do not disable any safety devices.
- Observe the notes regarding safety provided for the enclosure installation.
- Any work may only be carried out by authorised, trained personnel.
- When making changes to the enclosure (e.g. new location or installation of new components), always read the Rittal assembly instructions (system documentation) beforehand and heed the instructions during work.

- The cooling unit requires good ventilation. Always keep the air inlets and outlets free.
- Heed the ambient temperature (see “Technical Data” on the name plate).
- The resulting condensate must always be allowed to flow off unhindered. Do not damage or remove the drain unit. See also “Condensate Discharge” in the assembly instructions.
- Always de-energise the cooling unit and protect it from being switched on accidentally before opening it.
- Do not reach into the running cooling unit (fans are running).
- The values set for the cooling unit may only be changed by authorised persons who have been trained accordingly.

- The closed cooling circuit contains coolant and oil, which must be disposed of in the stipulated manner (protection of the environment).

3 Microcontroller

3.1 General

The microcontroller controls the internal temperature of the enclosure and monitors the cooling unit.

The cooling unit as supplied by Rittal is already set to the standard parameters (e.g. internal enclosure temperature, see table 3.3.4).
These parameters can be adjusted accordingly when required for special purposes or when fault messages are issued.

ATTENTION The values set for the cooling unit may only be changed by authorised persons who have been trained accordingly.

The following parameters can be changed without using a code:

- the setpoint for the internal enclosure temperature T_i
- the setpoint for the filter mat monitor
- the unit to be used °C / °F

The following parameters can be changed after a code has been entered:

- the adjustable minimum value for T_i
- the adjustable maximum value for T_i
- the setpoint tolerance for fault message “1”
- the mode of the PLC interface
- the cut-off of the internal fan
- the address of the master/slave cooling unit (only if the cooling units are integrated in the SK bus system)

The set parameters are retained even if the power supply is interrupted.

3.2 Display and Control Unit

See also illustration **A.**

Legend:

1	Numeric display		(max. of three digits)
2	LED	°F	Degree Fahrenheit
3	LED	°C	Degree Celsius
4	Key	[TEST]	Calls up the test function
5	Key	[ENTER]	Programming
5a	LED	[ENTER]	Indicator for key (5)
6	Key	[↑]	Programming
6a	LED	[↑]	Indicator for key (6)

The display (1) indicates:
During start-up:
software information (version number)

During operation:
the current internal enclosure temperature,
an open enclosure door (internal temperature display is flashing)

In case of system malfunctions:
the fault number, alternating with the internal enclosure temperature

During programming:
1. the selected programming level
2. the current parameter

3.3 Operation of the Microcontroller

3.3.1 Test Mode

In the test mode, a function check of the device is carried out at a low internal enclosure temperature, regardless of the state of the door limit switch.

Operation	Effect	Explanation
Switch on the voltage supply	The internal fan is running continuously.	
	The internal enclosure temperature is displayed.	
Press the [TEST] key (4)	The compressor and the external fan are switched on. After ca. 5 min., the compressor and the external fan are switched off automatically.	If a malfunction occurs, it is indicated along with the appropriate fault number on the display (1), alternating with the internal enclosure temperature.

NOTE A high level of humidity can cause condensation. Make sure the condensate can drain off freely!

3.3.2 Programming

See also diagram **B.**

ATTENTION The values set for the cooling unit may only be changed by authorised persons who have been trained accordingly.

The programming mode consists of 4 main program levels, 5 subprogram levels (standard; see sections 3.1 and 3.3.4) and 1 subprogram level (BUS system, see chapter 5).

To call up the programming mode:
simultaneously press keys [ENTER] (5) and [↑] (6) for 10 sec.

Programming occurs using keys (5) and (6):

[ENTER]
- Calls up the individual levels
- Saves the parameter and calls up the next level number

[↑]
- Selects the individual levels
- Sets the parameters
- Returns to the operating mode

ATTENTION Only those values that have been confirmed using the [ENTER] key are written to the EEPROM.
If no entries have been made for 60 sec. in the programming mode, the device is automatically switched back to the operating mode. Displayed values that have already been changed are used during operation but will not be saved. After the power supply has been switched off, the saved values will be used again.

3.3.3 Operating Mode / Programming Mode – Selection of Programming Levels

The steps required for selecting and operating the individual levels are shown in diagram **B**.

3.3.4 Parameter Settings

Level	Changeable parameters	Min. value	Max. value	Default (Rittal)	Act. value	Explanation
1	Setpoint for the internal enclosure temperature T_i	30	45	35		The preset minimum value (30°C) can be changed on level 5. The preset maximum value (45°C) can be changed on level 6.
2	Setpoint for the filter mat monitor	4	40 99 = off	99		Proceed as follows to adjust the setpoints (setting range 4 – 40 K (Kelvin), switching hysteresis 2 K (Kelvin) permanently set): 1. After having inserted a clean filter mat, switch on the cooling unit and let it run for a few minutes. 2. Call up level 2. 3. Press the [TEST] key for ca. 10 sec. The temperature difference is shown. 4. Using the [↑] key, set the temperature difference so that it is ca. 10 K (Kelvin) above the displayed value.
3	Unit °C / °F	0	1	0		The current temperature unit is indicated by the appropriate LED, i.e. (2) or (3).
4	Code			123 101		Enter the code 123 to access levels 5 – 9 (standard). Enter the code 101 to access level 50 (BUS system; see chapter 5).
5	Adjustable minimum setpoint for the internal enclosure temperature	20	35	30		Adopted as the minimum value in level 1.
6	Adjustable maximum setpoint for the internal enclosure temperature	40	55	45		Adopted as the maximum value in level 1.
7	Setpoint tolerance for fault message “1”	3	15	5		If the internal enclosure temperature exceeds the setpoint by 5 K (Kelvin) (standard) or more, the fault message “1” (“internal enclosure temperature is too high”) appears on the display.
8	Mode of the PLC interface	0	1	0		Selects the output mode of the PLC interface (see chapter 4): “0” = normal mode “1” = parallel fault encoding
9	Cut-off of the internal fan	0	1	0		“0” = normal operation Following a setpoint cutoff, the internal fan is switched off for ca. 1 min. to improve draining of condensate. “1” = special case A cut-off is prevented.

3.4 Door Limit Switch

If a door limit switch is connected to terminals 1 and 2, the cooling unit is switched off ca. 10 sec. after a door has been opened to avoid an increase in condensation. The display (1) flashes.
After the door has been closed, the internal fan immediately starts up. The external fan and the compressor start after a delay of ca. 3 min. This prevents excessive starting current. During this time, the display (1) continues to flash.

3.5 Fault Messages

If a malfunction occurs in the cooling unit, the pertaining fault number (see the table below) is shown on the display (1), alternating with the current internal enclosure temperature (2 sec pulse).
If several malfunctions have occurred simultaneously, they are displayed one after another.

Example: If the filter mat is soiled (fault 7), thus decreasing the cooling output (fault 1), the display will read as follows (flashing numbers): 35 / 1 / 7 / 35 / 1 / 7 / 35 etc.

ATTENTION Always heed the notes regarding safety (see chapter 2) when performing work on the cooling unit.

Fault number, cause, remedy

No.	Malfunction	Message because...	Cause		Who ?	Remedy
1	Internal enclosure temperature too high	Alarm value (ΔT) exceeded	Fault resulting from faults "2" – "7"	Faults "2" – "7" and fault "1" alternate in the display (flashing)		Eliminate faults "2" - "7"
			Insufficient cooling output	The ambient temperature is too high (e.g. sun irridiation)		Take measures to reduce the ambient temperature (e.g. ventilate the room)
				Too much heat building up in the enclosure		Retrofit with a larger cooling unit (information)
				The value set as the setpoint for the internal enclosure temperature is too low		Set the maximum permissible setpoint for the internal enclosure temperature (T_i)
				The value set as the setpoint tolerance (ΔT) is too low		Set the maximum permissible setpoint tolerance (ΔT)
			Device is defective	The compressor is defective		Check and, if necessary, replace the compressor
				Lack of coolant		Check whether the internal air is cooled: cold = see the causes given above warm = repair required, to be carried out by a refrigeration engineer

No.	Malfunction	Message because...	Cause		Who ?	Remedy
2	Compressor	Alternating current: current flow to the compressor has been interrupted Three-phase current: temperature monitor is evaluated	Overload	Internal winding protection or thermal monitor		Wait. The device is automatically switched on again. If the malfunction occurs repeatedly => carry out the following measures
			Temperature range (T_A) has been exceeded	The ambient temperature is too high (e.g. sun irridiation)		Take measures to reduce the ambient temperature (e.g. ventilate the room)
			Air throughput is too low	The external air circuit is soiled or blocked		Clean using compressed air or ensure proper ventilation
				The condenser is soiled		Clean using compressed air
				Fault resulting from “5”		Eliminate fault “5”
			Connections or leads are defective			Check and, if necessary, replace or repair the connections and leads
			None of the above causes can be determined	The compressor is defective		Repair or replace the compressor
3	Cooling circuit	Temperature measurement in the cooling circuit	Danger of icing (the compressor and the external fan are switched off)	The value set as the setpoint for the internal enclosure temperature is too low		Set the maximum permissible setpoint for the internal enclosure temperature (T_i)
				The temperature has dropped out of the permitted range (T_A)		Take measures to increase the ambient temperature (e.g. heat the room)
				The air duct in the enclosure is blocked		Modify the air duct to produce a sufficient air flow
				Fault resulting from “6”		Eliminate fault “6”
				None of the above causes can be determined		Repair or replace
			Lack of coolant (the compressor and the external fan are running)			Repair or replace

No.	Malfunction	Message because...	Cause		Who ?	Remedy
4	High-pressure monitor	Pressostat has been triggered	Temperature range (T_A) has been exceeded	The ambient temperature is too high (e.g. sun irridiation)		Take measures to reduce the ambient temperature (e.g. ventilate the room)
			Air throughput is too low	The external air circuit is soiled or blocked		Clean using compressed air or ensure proper ventilation
				The condenser is soiled		Clean using compressed air
				The external fan is defective		Replace
			None of the above causes can be determined	The expansion valve or the high-pressure monitor is defective		Replace or repair
5	External fan	Alternating current: current flow to the fan has been interrupted Three-phase current: temperature monitor is evaluated	Overload	Internal winding protection or thermal monitor		Wait. The device is automatically switched on again. If the malfunction occurs repeatedly => carry out the following measures
				The fan is dragging or a bearing is damaged		Replace or repair
				Incorrect rated operating voltage or frequency		Select a different rated operating voltage or frequency
				The ambient temperature is too high (e.g. sun irridiation)		Take measures to reduce the ambient temperature (e.g. ventilate the room)
			Blocked	By an object		Carefully remove the object
				Damaged bearing		Replace
			Connections or leads are defective			Check and, if necessary, replace or repair the connections and leads
			None of the above causes can be determined	The external fan is defective		Replace

No.	Malfunction	Message because...	Cause		Who ?	Remedy
6	Internal fan	Alternating current: current flow to the fan has been interrupted Three-phase current: temperature monitor is evaluated	Overload	Internal winding protection or thermal monitor		Wait. The device is automatically switched on again. If the malfunction occurs repeatedly => carry out the following measures
				The fan is dragging or a bearing is damaged		Repair or replace
				Incorrect rated operating voltage or frequency		Select a different rated operating voltage or frequency
				The ambient temperature is too high (e.g. sun irridiation)		Take measures to reduce the ambient temperature (e.g. ventilate the room)
			Blocked	By an object		Carefully remove the object
				Damaged bearing		Replace
			Connections or leads are defective			Check and, if necessary, replace or repair the connections and leads
			None of the above causes can be determine	The internal fan is defective		Replace
7	Filter monitoring	Setpoint for filter mat monitoring has been exceeded	No filter mat installed			Switch off the filter mat monitor (level 2 => 99 = off) or install a filter mat
			Filter mat is soiled			Clean or replace
			The value set as the setpoint for filter mat monitoring is too low			Reset the setpoint (see level 2 in the table in section 3.3.4, “Parameter Settings”)
			Air throughput is too low	The external air circuit is soiled or blocked		Clean using compressed air or ensure proper ventilation
				The condenser is soiled		Clean using compressed air
				Fault resulting from “5”		Eliminate fault “5”

No.	Malfunction	Message because...	Cause		Who ?	Remedy
8	Temperature sensor	Permissible range was exceeded	Connections or leads are defective			Check and, if necessary, replace or repair the connections and leads
			Display: “8” + “00” “8” + “99”	The internal sensor is defective		Replace
			Display: “8” + “3”	The icing sensor is defective		Replace
			Display: “8” + “7”	The temperature sensor for the external air circuit is defective		Replace
9	Phase monitoring (3-phase current only)		Phase is missing			Voltage measurement; connect all phases
			Incorrect phase			Reverse two phases

Symbols:

Authorised operator

Internal service department (maintenance) (see the assembly instructions)

Rittal service department

3.6 Cleaning

ATTENTION Always de-energise the device and protect it from being switched on accidentally before opening it!
Always heed the notes regarding safety (see chapter 2) when performing work on the cooling unit.

External air circuit

Depending on the degree of soiling, clean the components of the external air circuit using compressed air.

Filter mat (option)

If the filter mat is visibly soiled or the filter mat monitoring system is triggered (fault 7):

☞ Remove the cover on the air intake side (external air circuit).

☞ Clean or, if necessary, replace the filter mat.

☞ Reinstall the cover.

4 PLC Interface

The interface is used for transferring the current internal enclosure temperature as well as any existing system messages from the cooling unit to the programmable controller (PLC).

NOTE See the assembly instructions for the cooling unit for more information.

5 BUS System (Model No. SK 3124.000)

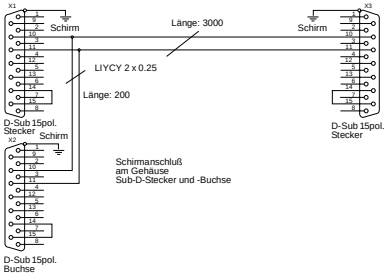
5.1 General

The BUS system allows a maximum of 7 cooling units to be interconnected. As a result, the following functions are available to the operator:

- parallel temperature display
- parallel unit control
  (the cooling units in the network can be simultaneously switched on and off)
- parallel door status messages (“door open”)
- collective fault message

The data exchange is carried out using cables (shielded two-wire leads).

BUS cable (Rittal Model No. SK 3124.000)



All units are assigned an address. This address also includes the ID for “Master” or “Slave”.
The BUS system cannot be used to link the cooling units to a PC.

The PLC interface is switched to parallel error encoding.

NOTE The following restrictions must be heeded:
only 6 outputs (0 to 5) are available;
outputs 5, 6 and 7 are routed in parallel to output 5.

5.2 Notes Regarding Installation

ATTENTION The electrical signals at the interface are of an extra-low voltage (not extra-low safety voltages according to EN 60 335). Always heed the following notes!

- De-energise the cooling units to be connected.
- Ensure proper electrical insulation.
- Make sure the cables are not laid in parallel to power lines.
- Make sure that the lines are short.

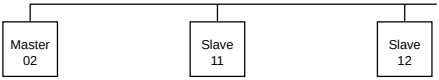
5.3 Programming the Cooling Unit

See diagram **B** for details on programming.
IDs:

Master cooling unit		Slave cooling unit	
00	Basic state	00	Basic state
01	Master with 1 slave	11	Slave with address 1
02	Master with 2 slaves	12	Slave with address 2
03	Master with 3 slaves	13	Slave with address 3
04	Master with 4 slaves	14	Slave with address 4
05	Master with 5 slaves	15	Slave with address 5
06	Master with 6 slaves	16	Slave with address 6

NOTE Only one unit may be configured as master; the address ID must match the number of slave units.
The individual slave units must have different addresses; the addresses must be in ascending order (without gaps in between).

Example: 1 master cooling unit with 2 slave cooling units



6 Rittal Diagnostic Software for PC (RiDiag) (can be retrofitted)

Using the RiDiag program, all data available in the microcontroller of a cooling unit can be retrieved, edited or deleted from a PC.
The RiDiag program is a DOS program that can also be called up under Windows. To order the program, use the Rittal Model No. “SK 3159.000”.

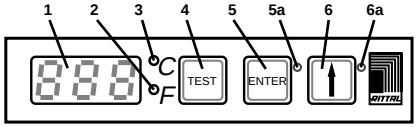
The following data can be read out:

- the faults that occurred and the frequency at which they occurred
- the maximum ambient temperature measured
- the lowest internal enclosure temperature measured
- the switch-on times of the cooling unit
- the switch-on times of the compressor
- the utilisation of the unit

The parameters described in section 3.3.4 can be set.

NOTE A detailed description of the installation procedure and of the operation is included with the software.

A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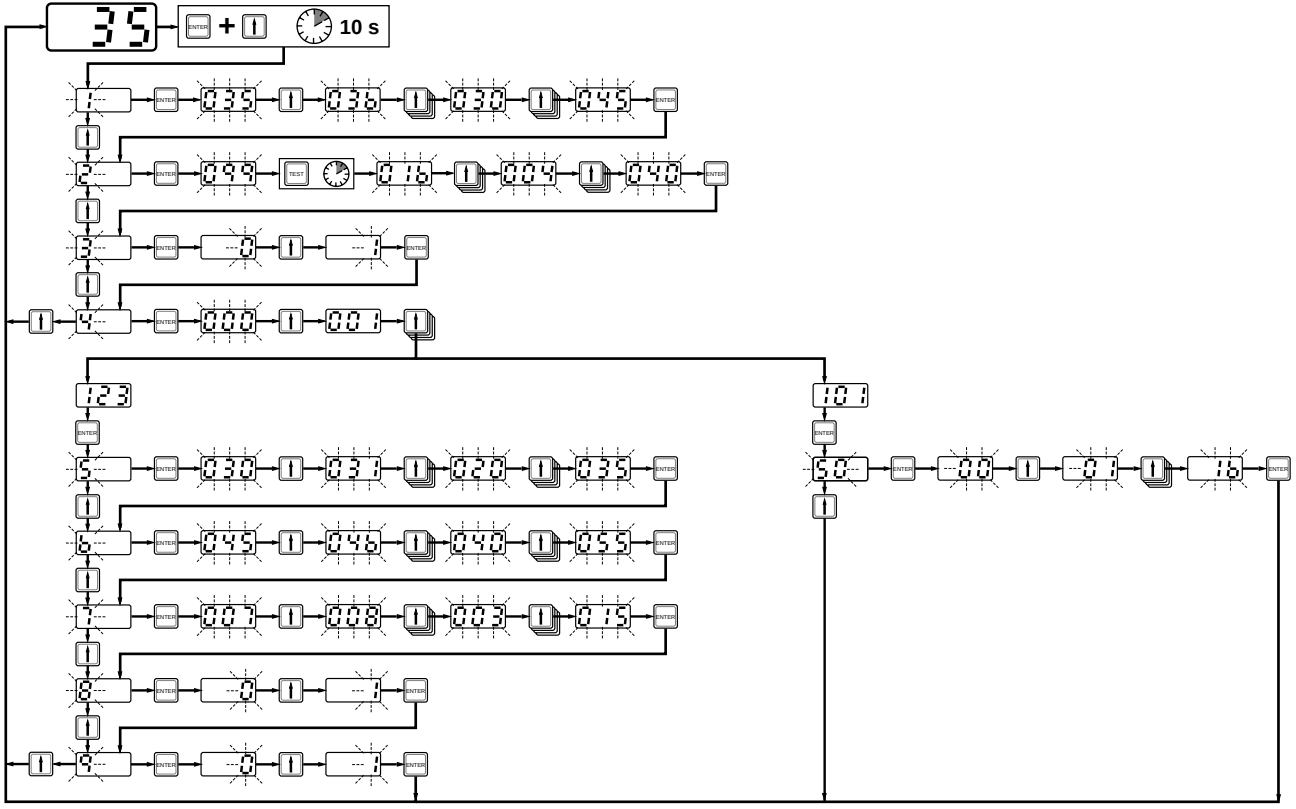
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